Introduction

The Slotted Stud Tie (Type I) system consists of a Slotted Stud Plate (Type I) (which is a vertically oriented steel plate), a V-Tie™ (a V-shaped steel wire), and an Insulation Support (a polyethylene retainer). Individual components are shown in Figures 1, 2 and 3. The assembly is shown in Figure 4, and the installed tie system is illustrated in Figure 5.

Lateral loads applied to the masonry veneer are transferred through the V-Tie™ to the Slotted Stud Plate which is fastened directly to a structural backing without any intervening material such as sheathing. The Stud Plate is fastened to a side surface of structural backing member such as a steel stud or wood stud (see Cover Illustration and Figure 5). The vertical slot along the outboard end of the Slotted Stud Plate through which the V-Tie™ is inserted provides a positive connection without the possibility of V-Tie™ disengagement during construction and in service (in accordance with the requirements of CSA A270 and AG 530-1 [A524-6/1994 (D)]. The slot permits up to 50 mm (2") of net vertical adjustment so that a load joint in the masonry veneer will always be coincident with the V-Tie™ regardless of the placement of the Stud Plate vertically along the supporting structural member. The vertical slot also accommodates vertical differential movement between the masonry veneer and the structural backing.

The Insulation Support, which is inserted over the end of the Stud Plate and restrained by the V-Tie™, is used to secure and mechanically fix the cavity insulation in place.
Introduction

The Slotted Stud Tie (Type 1) can accommodate a range of insulation thicknesses from 0 to 105 mm (0 to 4") and air space widths of 25 mm (1") and greater. The Slotted Stud/Plate has sufficient length to accommodate the thickness of the cavity insulation and sheathing, and further extends 18 mm (0.7") into the air space to express its leading edge and facilitate in-situ placement of the V-Tape® and Insulation Support. The V-Tape® is inserted through the vertical slot along the leading edge of the Stud Plate and placed coincident with a mortar bed joint so as to extend horizontally and normally to the structural backing, thereby maintaining its capacity. The legs of the V-Tape® are positioned along the centreline of the masonry veneer within the placement tolerances permitted by the building code having jurisdiction. Adjustment normal to the wall is facilitated by on-site selection of an appropriate length of V-Tape®.

The Slotted Stud Tie (Type 6) is capable only of transferring forces perpendicular to the wall and not parallel to the wall. Therefore, composite action cannot be achieved between the masonry veneer and the structural backing. For the design of shear connected masonry veneer/steel stud wall systems (i.e. composite wall construction), see Fero Stud Shave™ Connector product literature.

Components and Specifications

Slotted Stud Plate (Type 8): The Slotted Stud Plate (Type 8) [Figure 1] is manufactured from 16 gauge sheet steel (0.067 mm (0.005") minimum base metal thickness) and is available in both hot-dip galvanized finish and stainless steel. The weight of hot-dip galvanized finish is not less than 400 g/m²(1.5 lb/ft²) and satisfies the requirements of CSA-A370 (which references ASTM A 153), A53/A53A/A53B/A795 602 (which reference ASTM A 53, Class B), and the International Building Code (IBC) (which reference ASTM A 53, Class B).

The Slotted Stud Plate Type 8: specification length (S), refers to the actual width of the steel stud into which it is connected; the specification length (L), refers to the actual thickness of the insulation plus sheathing plus sheathing; and the length (P), refers to the length of projections of the Slotted Stud/Plate (Type 8) into the air space.

Figure 1: Slotted Stud/Plate (Type 8)
The overall length of the Slotted Stud Plate (Type 1) is 10 mm (0.394") longer than the specification lengths (5 to 60). Specification lengths can vary to accommodate standard stud widths (152 mm (6"), 152 mm (6") and 203 mm (8")) and thickness of insulation plus sheathing membrane plus sheathing. (IG) of 0 mm (0") and greater. The Slotted Stud Plate (Type 1) is available in standard lengths, (IG) of 0 mm (0"), 25 (1") 51 (2"), 76 (3") 92 (3.5") and 105 (4.1") mm Intermediate sizes are also available.

The 55 mm (2.2") long 5.8 mm (0.22") wide slot at the end of the Slotted Stud Plate (Type 1) facilitates 55 mm (2.2") of construction adjustability and in service differential movement between the Stud Plate and the V-Flm™. Holes having 12.7 mm (0.5") are punched through the body of the Slotted Stud Plate. When the plate is mounted, three holes are located within the cavity insulation, and minimize thermal conductivity through the tie system.

Four 6.35 mm (0.25") diameter screws hole width, (IG) of the Slotted Stud Plate (Type 1) provide for plate fastening to the structural backing member. Maximum screw size is #12.

V-Flm™. The V-Flm™ (Figure 3) is manufactured from 4.76 mm (0.18") diameter wire and is available in both hot-dip galvanized (black) and stainless steel. The weight of hot-dip galvanized finish is not less than 480 g/m² [1.7 oz/sq. ft] and satisfies the requirements of CSA A270 (which references ASTM A123, A520/A520M-602, which references ASTM A-153, 458 g/m² [16 oz/sq. ft] and the International Building Code (IBC) which references ASTM A53, Class B, 458 g/m²]

The V-Flm™ is available in a variety of standard lengths to accommodate different specified thickness of masonry veneer and design width of air space. The V-Flm™ specification lengths (L) should be selected to provide for placement of the legs of the V-Flm™ along the centerline of the masonry veneer (target length of the V-Flm™) appropriate selected by the masonry on the joist, facilitated in side adjustment normal to the structural backing (to accommodate construction tolerances) where the constructed width of air space differs from the design width of air space. Standard lengths of V-Flm™ include 60 mm (2.4"), 80 mm (3.1"), 100 mm (3.9"), 120 mm (4.7"), 140 mm (5.5"), 160 mm (6.3"), 180 mm (7.1"), 200 mm (7.9"), 225 mm (8.9") and 250 mm (9.8") For example, the 60 mm (2.4") V-Flm™ is utilized in the Slotted Stud Tie (Type 1) system consisting of 25 mm (1") air space and 92 mm (3.5") masonry veneer.

Insulation Support. The Insulation Support (Figure 2) is manufactured from polyethylene. It is pressed by hand over the outbound end of the Slotted Stud Plate tightly against the cavity insulation to prevent the insulation from separating from the structural backing or barrier/sheathing membranes. The friction is between the Insulation Support and the Slotted Stud Plate restrains the insulation during construction which is commonly installed in advance of the exterior masonry veneer. Subsequent installation of the V-Flm™ ensures the Insulation Support between the insulation and the V-Flm™ serves to lock the Insulation Support in place and ensuring a reliable and permanent insulation support system. The Insulation support is a standard component of the system, but it is optional where the insulation is otherwise supported, and not required where no insulation is placed within the air space.
Structural Action

The Slotted Stud Tie (Type 1) is designed to transfer the lateral load from the exterior masonry veneer usually and normal to the structural backing. The connection between the V-Tie™ and Slotted Stud Plate by way of the vertical slot does not restrain differential movement between the structural backing and the masonry veneer in the vertical direction, and therefore, does not offer composite action between the structural backing and the masonry veneer. For the design of shear connected masonry veneer (steel) stud systems (i.e., composite wall construction), see Fero Stud Shear™ Connector product literature.

The fasteners connecting the Slotted Stud Tie to the side surfaces of the structural backing member resist loads in shear. The orientation and location of the fasteners within the stud system, provide a more desirable connection to the structural backing than surface-mounted fasteners which subject the fasteners to direct tension and generally higher moisture loads.

Although four (4) holes are provided to receive fasteners, generally, (a minimum of) two (2) screws per connector are sufficient to resist the imposed masonry veneer loads.

Unit Masonry, Dimension Cut, and Manufactured Stone Veneer Applications

In addition to its use in unit masonry veneer applications, including both clay brick and concrete masonry, the Slotted Stud Tie (Type 1) system can be utilized in the application of conventional stone/masonry veneer set in mortar.

Slotted Stud Tie (Type 1) Design Data

Design data for the Slotted Stud Tie (Type 1) are reported separately for Canada and the United States in the following tables because design methods and requirements for masonry ties and their uses differ between their respective codes and standards.
### Slotted Shot Tie (Type 1) Design Data (Canada)

<table>
<thead>
<tr>
<th>Design Parameter</th>
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<tr>
<td>Deflection</td>
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<tr>
<td>Flange Tension</td>
<td>1000 MPa (145 ksi)</td>
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Notes:
- The tensile strength of the slotted shot tie is type C grade as specified in CSA A23.1.
- The design data is based on the following assumptions:
  - The shot tie is used in a construction setting.
  - The shot tie is not subject to any additional stresses such as those from wind or seismic loads.
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### Slotted Shot Tie (Type 1) Design Data (United States)

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Design Philosophy

Robert O. Drinkall, Ph. D., P.Eng., President of Drinkall Engineering and Associates (control) examined many tie bar usage in a brief report titled "Structural Requirements for Non-Loading Bearing Masonry Walls and Potential for Composite Action" dated September 4, 1991. In his report, Drinkall comments, "shearurally, composite action is a very attractive engineering idea. He further states that..."

The design of the Slotted Tie/Chain II not only satisfies this "conventional" wisdom, but also has been engineered to eliminate many issues problematic for a multi-component tie. A positive restraint between tie components to prevent disengagement; reduced mechanical free play; limited deformation under load; and "tie rolling," which places the tie beam in shear rather than direct tension and minimizes the shear load to which the fasteners are subjected.

The effects of increased differential movement upon the Slotted Ties/Chain II have been evaluated with regard to the following questions: 1. Will the tie bars fail in shear or pullout under cyclic loading? 2. What will be the effects of the cyclic loading on the tie bar and the wall with which it is integrated? 3. Will the tie bars fail at the gusset plate or the tie bar? 4. What is the effect of the cyclic loading on the wall? 5. Will the tie bars move freely or will they become jammed? 6. Will the tie bars move due to thermal expansion? 7. Will the tie bars move due to differential movement? 8. Will the tie bars move due to wind loading? 9. Will the tie bars move due to seismic loading? 10. Will the tie bars move due to differential movement and thermal expansion? 11. Will the tie bars move due to differential movement and wind loading? 12. Will the tie bars move due to differential movement and seismic loading? 13. Will the tie bars move due to differential movement and wind loading and seismic loading? 14. Will the tie bars move due to thermal expansion and wind loading? 15. Will the tie bars move due to thermal expansion and seismic loading? 16. Will the tie bars move due to thermal expansion and wind loading and seismic loading?